REMARKS/ARGUMENTS

Favorable reconsideration of the present application is respectfully requested.

Claim 2 has been amended for clarity and now recites that the emulation model includes a hydraulic pump, a hydraulic actuator and a plurality of hydraulic valves. The dependent Claims 3-4 have also been amended to be consistent with amended Claim 2.

Applicants wish to thank Examiner Heinrichs and Martin for the courtesy of an interview on October 5, 2005, at which time the outstanding rejection was discussed. Although no agreement was reached at that time, the present response includes amendments based upon the discussion held at that time.

The claimed invention is directed to a rotation driving device for a construction machine. Conventionally, the rotation devices of construction machines have been driven by hydraulic driving systems using hydraulic actuators which are controlled by manual operating members. More recently, it has been known to use an electric motor as the actuator. However, this has conventionally led to the problem that the responsiveness of the electric motor to a manual lever operation has been difficult to control.

In accordance with a feature of the claimed invention, the controller for controlling the electric motor according to an operation command from the operating member has an emulation model for simulating dynamic characteristics of a hydraulic rotational driving device in real time. For example, referring to the non-limiting embodiment of the figures, an electric motor 6 may be controlled by a controller 9 which computes an actuator revolving speed based upon the receipt of a manipulated variable of a control lever 12. In this case, the controller 9 for the electric motor includes a hydraulic driving system emulation model 9a which emulates a hydraulic driving system. It is thus possible to simulate the dynamic characteristics of a hydraulic driving device while using an electric motor, and therefore to provide control sensitivity comparable to that of a hydraulic driving system.

Claims 1, 5 and 6 were rejected under 35 U.S.C. § 102 as being anticipated by U.S. patent publication 2003/0127289 (Elgas et al). According to the Office Action, Elgas et al discloses a rotation driving device for a construction machine, including a controller that has an emulation model for simulating dynamic characteristics of a hydraulic rotational driving device in real time. However, as discussed during the interview, Elgas et al does not in fact disclose a controller having an emulation model for simulating dynamic characteristics of a hydraulic rotational driving device.

Elgas et al discloses an electric vehicle such as a forklift which is driven by an electric motor 3. The electric motor 3 operates a hydraulic pump for the lift (paragraph [0065]) and is controlled by an arithmetic unit 14 which includes a "drive model 20 that simulates the rotating field drive [of the motor] 3" (paragraph [0068]). Therefore, as Applicants pointed out during the interview, Elgas et al does not disclose an emulation model for simulating dynamic characteristics of a *hydraulic* rotational driving device in real time, but instead simply simulates the rotating field drive of the *electric* motor 3 which is being controlled.

The Examiners postulated during the interview that it may nonetheless have been obvious to have instead simulated a hydraulic rotational driving device in the driving model 20 of Elgas et al. However, such a modification would *not* have been obvious to those skilled in the art, if only because it would have rendered Elgas et al unsatisfactory for its intended purpose ("THE PROPOSED MODIFICATION CANNOT RENDER THE PRIOR ART UNSATISFACTORY FOR ITS INTENDED PURPOSE"; M.P.E.P. § 2143.01). According to Elgas et al, the drive model 20 simulating the rotational field drive 3 determines the values of the flux linkage Ψ, the torque T and the rotational speed n of the electric motor (paragraph [0068]). These factors, including the flux linkage Ψ, "may be used in very many ways for the drive control of the rotating field motor 3" (paragraph [0061]), for example to detect faults in the motor field 3 (paragraph [0066]). Replacing the model that simulates the rotating electric

field drive 3 with an emulation model for simulating dynamic characteristics of an unrelated, non-electrical drive, i.e., a hydraulic rotational driving device, would render Elgas et al unsatisfactory for its intended purpose since it would then be impossible to determine the value of the flux linkage of the electric motor 3 or to provide motor fault detection. Thus, the simulation of a hydraulic rotational driving device in Elgas et al would have been incompatible with the disclosure of Elgas et al, and so would not have been obvious to one skilled in the art. The claims therefore clearly define over this reference.

Claim 2 depends from Claim 1 and further recites that the emulation model includes a hydraulic pump, a hydraulic actuator and a plurality of hydraulic valves. This is shown, for example, in Figure 4 wherein the emulation model 9a includes the hydraulic pump 20, the hydraulic actuator 21 and the plurality of valves 25-27. Claims 2-4 were rejected under 35 U.S.C. § 103 as being obvious over Elgas et al in view of U.S. patent 5,953,977 (Krishna et al) which was cited to teach an emulation model that includes a hydraulic actuator and various valves.

Krishna et al discloses a hydraulic machine including hydraulic components 26-32 which include hydraulic actuators and are driven by hydraulic pressure from the hydraulic pumps 16-17 via control valves 18-24. The capacity of the variable displacement pumps 16 and 17 is controlled by a controller 34. A motion planner 36 provides an input to the controller 34. The motion planner must have knowledge of the dynamic response and constraints of the machine in order to determine the optimal paths for the hydraulic components 26-32 (column 3, lines 57-60). The controller 34 therefore incorporates a linear dynamic model using look-up routines to provide data pertaining to the steady state response of each of the components 26-32. The look-up tables contain data pertaining to the maximum rate that a movable component may be driven based on the position commands and the pressure loads on the cylinders of the movable components that are driven by the pump

(column 4, lines 1-21). For example, as is illustrated in Figure 4, a boom position command may be fed through a boom controller model 126 and a boom lookup table 90 in order to output the boom velocity.

Krishna et al thus discloses the control of a hydraulic system including hydraulic actuators via an electronic controller that emulates components of the hydraulic system. However the components being emulated do not include a hydraulic pump and so, as a threshold matter, Krishna et al is incapable of suggesting a modification of Elgas et al whereby an emulation model includes a hydraulic pump.

Additionally, Krishna et al simply teaches the control of a hydraulic actuator by emulating the *same* kind of system, i.e., a hydraulic device. This is what is already done in Elgas et al: controlling an electric actuator by emulating an electric device. Thus Krishna et al would not have motivated one skilled in the art to modify Elgas et al to instead emulate a *different* kind of system.

Finally, as already explained, the modification of Elgas et al to emulate a hydraulic rotational driving device would have been incompatible with the disclosure of Elgas et al, and so would not have been obvious to those skilled in the art for this reason.

Accordingly, Claims 1 and 2 define over the prior art. The remaining claims dependent from Claims 1 or 2, and so are also unobvious in view of the prior art.

Applicants therefore believe that the present application is in a condition for allowance and respectfully solicit an early Notice of Allowability.

Respectfully submitted,

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